High-resolution geochemical characterization of ombrotrophic peat bogs from northern Alberta

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Ombrotrophic peat-bogs are peatlands developed under only atmospheric water input, which constitute approximately 75% of northern Alberta[1]. Here we evaluate subtle compositional changes on the bottom section of a peat-bog core in order to identify the potential input of petroleum from the Alberta oil sands. The bottom 34 cm of a core containing sediment overlain by a peat-bog was subsampled and cold extracted. The soluble material was analysed by two techniques, Gas Chromatography Mass Spectrometry (GC-MS) and Fourier Transform Ion Cyclotron Resonance-Mass Spectrometry (FTICR-MS) using electrospray ionization in negative ion mode (ESI-N) and atmospheric pressure photoionization in positive (APPI-P) ion modes.

The total extractable organics relative to the total sample mass varied from 0.33 to 3.49 % for the peat and from 0.18 to 0.44 % for the sediment. APPI-P results show that peat samples contain cyclic hydrocarbons with 3 to 10 double bond equivalents (DBE) with a strong predominance at DBE 6, while the sediments contain a broader distribution of hydrocarbons with similar abundances from 3 to 15 DBEs. O_7 to O_9 heteroatom compounds are abundant at the top of the peat-bog section decreasing with depth, accompanied with an increase of O_1 through O_3, nitrogen and sulfur-containing compounds (e.g., O_4S, O_3S and O_2S) in ESI-N. GC-MS data show an odd over even prevalence of *n*-alkanes, *n*-alkan-2-ones maximizing at C_{27} and C_{29}, respectively and a predominance of phytosterols (sitosterol and stigmasterol) over triterpenoids all of which indicate in situ higher plant detritus. Although changes in the molecular composition with depth suggest in situ biomass input and ongoing microbial degradation and humidification processes, the distribution of alkyl-phenanthrenes in the sediment and adjacent peat suggest mature organic matter is most likely a fingerprint from compounds derived from the oil sands. Our preliminary results demonstrate great potential of this technique for studying the presence of oil-derived compounds in complex organic mixtures such as peat-bogs.

[1] Vitt et al. (1994). *Artic and Alpine Research*. **26** (1): 1-13.